

Application No.: 10/723,319

130759-1

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Assistant Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450 on NOVEMBER 10, 2005 (Date).

Typed or printed name: RITA M. LYNCH

Signature: Rita M. Lynch

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:

Anthony John Dean et al.

: Group Art Unit: 3746

Application No. 10/723,319

: Examiner: TJ Kim

Filed: November 25, 2003

:

For: PULSE DETONATION POWER  
SYSTEM AND PLANT WITH  
FUEL PRECONDITIONING

**AFFIDAVIT UNDER 37 CFR 1.131**

Assistant Commissioner for Patents  
Alexandria, VA 22313-1450

S I R:

We, Anthony John Dean and Ivett Alejandra Leyva, being duly sworn, depose and  
state:

1. We are the coinventors of all of the claims of the patent application  
identified above and coinventors of the subject matter described and claimed therein.

2. Prior to July 20, 2003, we had conceived our invention as described and  
claimed in the subject patent application in the United States, as evidenced by the  
following:

- a. Exhibit A is a Patent Disclosure Letter dated October 28,  
2002 for the subject matter of the present patent  
application.

3. We were diligent in constructively reducing our invention to practice by filing the subject patent application in the United States on November 23, 2003, as evidenced by the following:

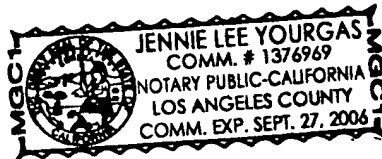
- a. Exhibit B is a print-out of a task item for our patent attorney, Penny A. Clarke, that provides a timeline for Ms. Clarke's preparation of the subject patent application.
- b. As indicated in Exhibit B, we discussed our invention with Ms. Clarke on January 17, 2003.
- c. As indicated in Exhibit B, Ms. Clarke then proceeded to draft a patent application and provided an application to Anthony John Dean for review February 24, 2003.
- d. As indicated in Exhibit B, Anthony John Dean and Ms. Clarke met to discuss the application August 14, 2003.
- e. As indicated in Exhibit B, Ms. Clarke revised the application per Anthony John Dean's feedback and sent a revised draft patent application to Anthony John Dean for review on August 22, 2003.
- f. As indicated in Exhibit B, Ms. Clarke discussed the patent application with Anthony John Dean and finalized the draft application Sept 16, 2003.
- g. As indicated in Exhibit B, Ms. Clarke then requested formal drawings and formal papers September 16, 2003.
- h. As indicated in Exhibit B, Ms. Clarke sent us the final draft patent application for our review and approval September 18, 2003.
- i. As indicated on the Assignment and Declaration for the subject patent application, Anthony John Dean signed the Assignment and Declaration on September 18, 2003, and Ivett Alejandra Leyva signed the Assignment and Declaration on September 22, 2003.
- j. The subject patent application was filed in the USPTO November 25, 2003 with formal drawings.

\_\_\_\_\_  
Anthony John Dean

\_\_\_\_\_  
*Ivett Alejandra Leyva*  
Ivett Alejandra Leyva

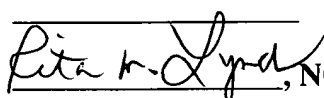
Sworn to and subscribed before me  
this 31<sup>st</sup> date of October 2005.

\_\_\_\_\_  
*Jennie Lee Yourgas*, NOTARY PUBLIC



  
Anthony John Dean 11/16/05

Sworn to and subscribed before me  
this 02 date of November 2005.

, NOTARY PUBLIC

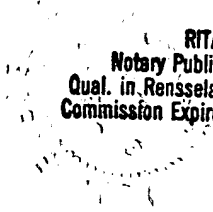
  
RITA M. LYNCH  
Notary Public, State of New York  
Qual. in Rensselaer Co. No. 01LY6079764  
Commission Expires 8/27/06

EXHIBIT A p 1 of 7

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GE Confidential & Proprietary Information.  
This invention is being prepared for submission  
to the GE Patent And Legal Operation. Attorney  
work product may be contained herein.

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## GE Patent Disclosure Letter System

### DOCKET NUMBER

31193

### DOCKET DATE

Monday, October 28, 2002

### TITLE OF INVENTION

Stationary Power Plant based on Pulse Detonation  
Combustors

### GE TECHNOLOGY AREA(S)

- Corporate R&D Advanced Technology Programs

### Keywords:

- Advanced Propulsion (PDE)
- GE Aircraft Engines (AEXX)
- GE Power Systems (PGXX)

Exhibit A p 2 of 7

**PROJECT NAME**

AT on pulse detonation engines

**PROJECT NUMBER**

21423510101

**PROJECT LEADER**

Dean, Anthony, J

**BUSINESS OR ORG. CONTACT INFORMATION**

NAME Harvey Maclin

**PHONE NUMBER**

Was this invention first conceived or reduced to practice in the performance of work under a contract between GE and another non-government third party? NO

Date Invention Conceived : June 2000

Circumstances Invention Conceived i.e., described in patent notebook (include page #), technical report, letter, discussed in meeting minutes, etc.  
Brainstorming about possible applications for PDE's.

Was this invention first conceived or reduced to practice in the performance of work under a US Government contract? NO

**ABSTRACT OF THE INVENTION**

Please write a brief explanation of the invention (Limit to 350 words)

This invention pertains to a hybrid engine where the traditional combined cycle power plant (Brayton cycle plus Rankine Cycle) is modified to include a pulsed detonation

Exhibit A p 3 of 7

combustor within the gas turbine. This will improve the efficiency of the engine because pressure rise within the PDC reduces the amount of energy required by the compression stage.

## BACKGROUND OF THE INVENTION

Please describe the problem or requirement addressed by your invention.

The problem that we are trying to solve is to increase efficiency of power plants (both simple cycle and combined cycle). In addition, a pulsed detonation combustor reduces the number of parts and size and complexity of the rotating machinery.

How has this problem or requirement been addressed before?

Now, to achieve high cycle efficiency, the Pressure ratio and the working temperature have to be as high as materials and cooling technology permits. This results in complicated high pressure compressors and turbines. The combustion process results in a 4-7% pressure loss.

Is this disclosure letter related to any GE disclosure letters, patent applications or issued patents?

NO

Have you completed a prior art search? NO

Please list any relevant literature or patents of which you are aware.

## DETAILED DESCRIPTION OF THE INVENTION

How does your invention work?

The combustion system is replaced by a pulsed detonation combustor (PDC). The PDC consists of a volume where a detonation is initiated in the fuel air-mixture. The volume can be a tube, or an arrangement such as a pre-conditioner of the fuel and then a detonation chamber. The products of the

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Exhibit A p. 4 of 7

detonation device are directed to the turbine. In an aero-derivative engine the PDC may replace the entire high pressure core. In a heavy-duty gas turbine, the PDC would require either a smaller compressor, or a turbine sized for higher pressure. There are several embodiments:

Embodiment 1: A pulsed detonation combustor (PDC) applied to a simple cycle (Brayton cycle) power plant. Embodiment 2: A pulsed detonation combustor applied to a combined cycle powerplant (Brayton plus Rankine cycle) Embodiment 3: O2 addition for improved detonability (O2 via air separation plant, or via O2-membrane for example) Embodiment: Fuel reforming using waste heat and available steam from combined cycle power plant.

**Describe the important features of your invention and explain how to use the invention to solve the problems described above.**

The key feature of this invention is pressure rise combustion using repeating detonations (in contrast to constant pressure combustion). Don't need the high pressure compressor to raise pressure. Does it with detonations or fast flames. Simplicity - replace high pressure spool with pulse detonation engine Less parts to the system. More cycle efficiency.

**What advantages are provided by your invention?**

Achieve higher cycle gain by using pressure rise combustion. Reduce number of parts of the system. Since this is a stationary system, one can use additives to make heavy-hydrocarbons detonate. The additives can be H2 or O2 and can be added to the main mixture to a predetonation mixture. In addition, steam can be used to reform the fuel prior to entering the detonation chamber. This results in higher cycle efficiency and a more detonable fuel.

**Has your invention been reduced to practice? NO**

**Briefly describe any efforts to make a prototype of your invention or to test your invention. Additionally, summarize the results of any related experiments and**

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Testing and highlight any results of particular significance.

A turbine-interaction rig is planned in '03 to test the viability of having flow from a pulsed detonation combustor enter a turbine section.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Please describe the significance of any pictures, drawings, graphs, diagrams, structures or figures and the type of picture along with the specific view or application to the invention.

Schematics of this invention are enclosed in the file "Pulsed Detonation Combustor.pdf".

#### CLAIMED INVENTION

Please identify novel aspects that should be protected within this disclosure letter.

Cycle based on pressure-rise combustion vs. Brayton cycle alone or in combination with Rankine cycle. Possibility of using additives such as H<sub>2</sub> and O<sub>2</sub> which are proven to be effective detonability enhances since there is no weight restriction. Also possibility of using steam for fuel reforming since it is readily available in combined cycle power plants. Higher propulsive efficiency Less moving parts - less weight.

#### ATTACHED FILES

Pulsed Detonation Combustor.pdf

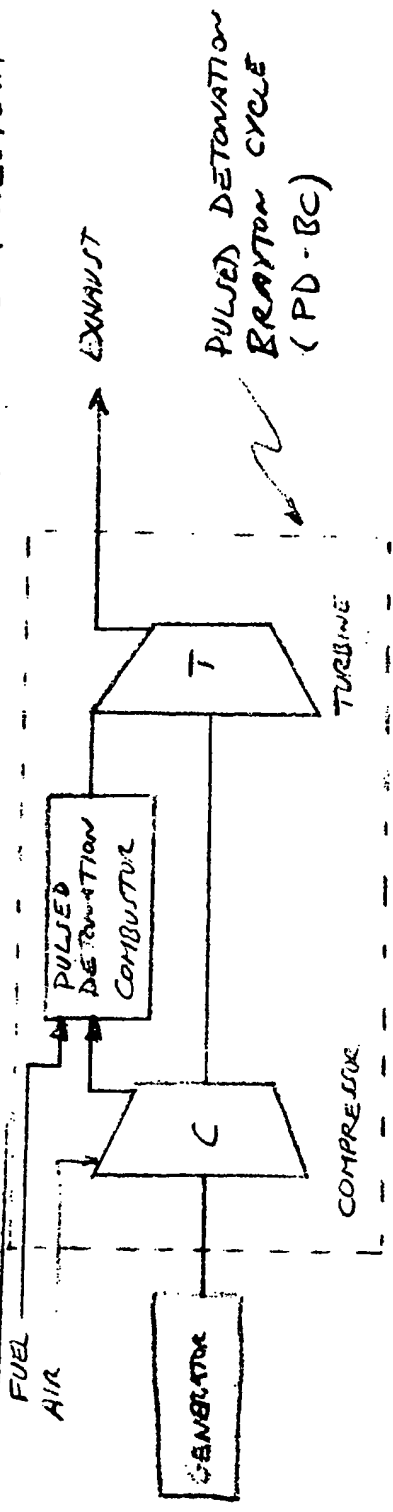
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Exhibit A p 5 of 7

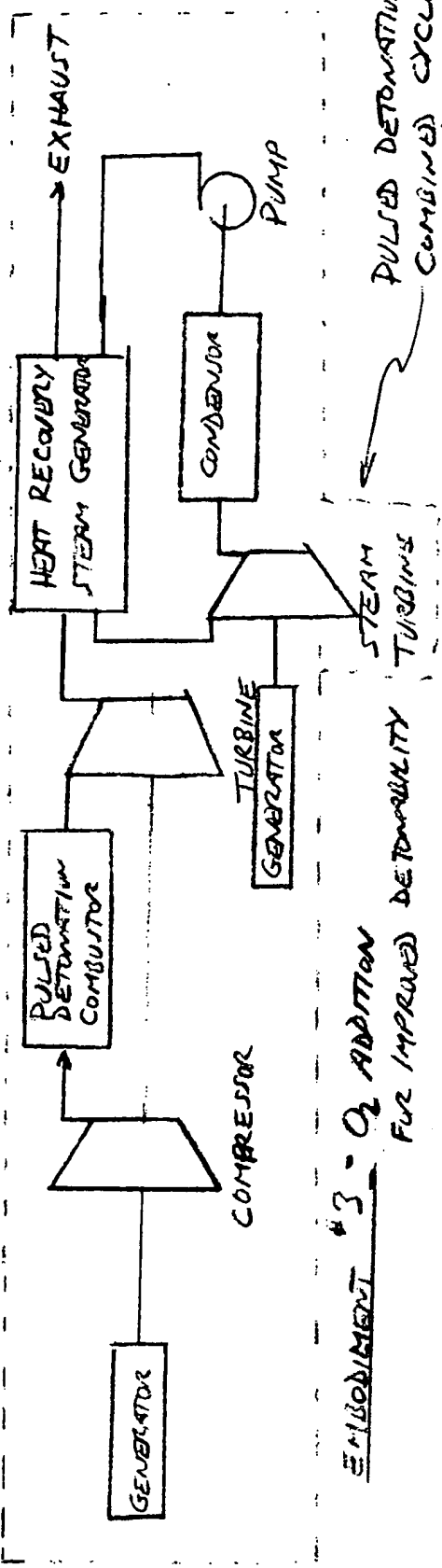
STATIONARY ENGINE POWER PLANT BASED ON PULSED DETONATION COMBUSTION

Tony D.

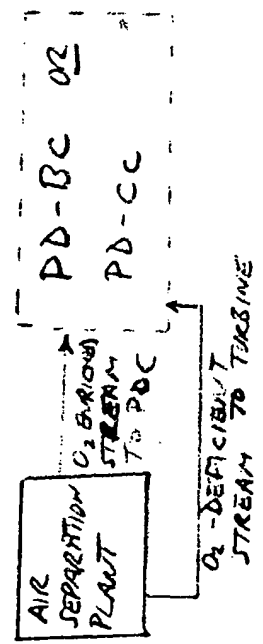
EMBODIMENT #1 - PDC MODIFICATION TO BRAYTON CYCLE POWER PLANT OCT. 22, 2003



EMBODIMENT #2 - PDC MODIFICATION TO COMBINED CYCLE POWER PLANT



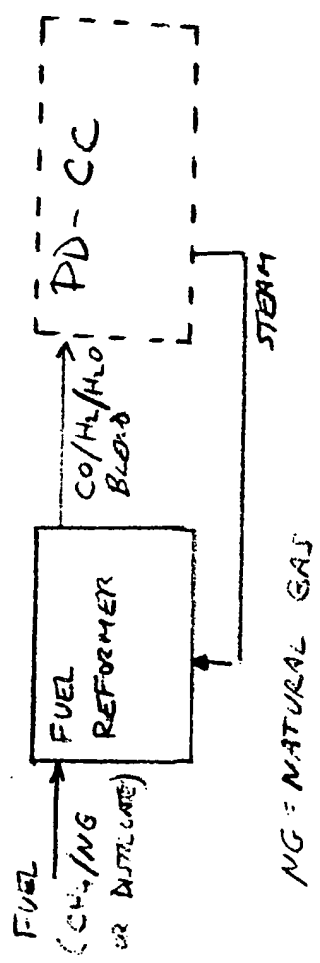
EMBODIMENT #3 - O<sub>2</sub> ADDITION FOR IMPROVED DETONABILITY



STATIONARY ENGINE POWERPLANT - BASED ON PULSED DETONATION COMBUSTOR

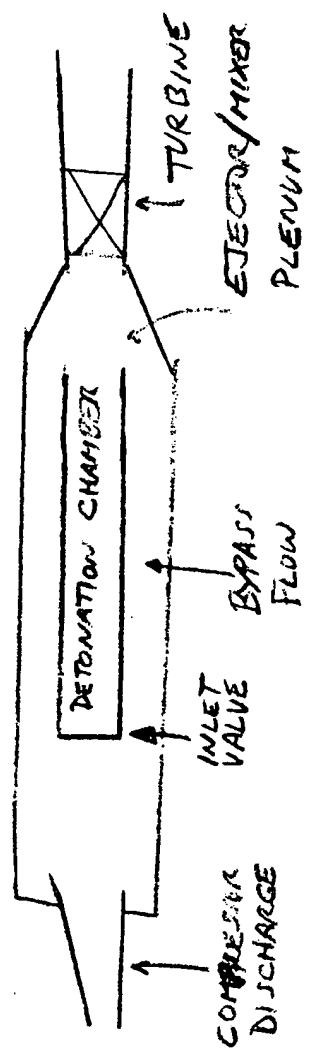
EMBODIMENT #4 - FUEL REFORMER FOR IMPROVED DETONABILITY

Tony Den  
OCT. 22, 1977



EMBODIMENT OF PULSED DETONATION COMBUSTOR - COMMON FEATURES

A. PDC WITH INLET VALVES, DETONATION CHAMBER, OUTLET PLENUM



**Clarke, Penny (Research)**

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**Subject:** 130759 First Office Action  
**Due Date:** Friday, November 11, 2005

**Status:** Not Started  
**Percent Complete:** 0%

**Total Work:** 0 hours  
**Actual Work:** 0 hours

**Owner:** Clarke, Penny (Research)

**Categories:** First Office Action

- 1) met w/ Ivett & Tony 1-17-03 & began drafting claims;
- 2) drafted application 2-20, 2-21 & 2-24;
- 3) application to Tony for review 2-24--req'd feedback by 3-10;
- 4) met w/ Tony Thur Aug. 14th to discuss application;
- 5) revised application per Tony 8-21/22 & sent to Tony 8-22 5PM for final review.
- 6) discussed w/ Tony 9-16. Finalized Sept 16th. Decl & assignment & formal drawings req'd Sept. 16th.
- 7) Sent to Ivett & Tony for final approval Sept. 18th AM.
- 8) US, FF, IDS, Checklist, PAGE updates to RL 11-21-03 for filing.
- 9) Link to complete drawings by Mon. 11-24-03. filed 11-25-03

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emailed Tony & Rita 5-4-04. submitted 5-18-04.

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prepared election of species and gave to Rita to submit July 20, 2005. submitted 7-21-05.